

3.4 Problem Solving

1. An projectile is shot vertically into the air with a speed of 130 m/s. Its height h , in metres, after t seconds is modelled by the relation. $h = -5(t - 12)^2 + 760$

- a) What is the maximum height of the projectile?
- b) When does the projectile reach its maximum height?
- c) How many second is the projectile in the air?
- d) State the Domain and Range as it applies to the situation.

2. On a forward somersault dive, Nina's height h metres above the water is modelled by the relation, $h(t) = -4.9(t - 2)(t + 1)$ where t is the time in seconds after she leaves the board.

- a) Find Nina's maximum height above the water.
- b) How long does it take her to reach the maximum height?
- c) How long is it before she enters the water?
- d) How high is the board above the water?
- e) For how long is she at or above 9.8m?

3. A ball is thrown straight up from the balcony of an apartment building and falls to the ground. The height h metres of the ball from the ground t seconds after being thrown is modelled by the relation.

$$h(t) = -4.9(t - 2)^2 + 22$$

- a) What is the maximum height of the ball above the ground?
- b) How long does it take for the ball to reach the maximum height?
- c) After how many seconds does the ball hit the ground?
- d) How high is the balcony above the ground?

4. A golf ball is hit from ground level. Its path is modelled by the relation $h(t) = -4.9t(t - 6.24)$, where h is the ball's height above the ground, in metres, and t is the time, in seconds.

- a) For how long will the ball travel before it hits the ground?
- b) How long will it take for the ball to reach the maximum height?
- c) What is the maximum height of the ball?
- d) For how long is the ball at or above 10 m?

5. A quarterback passed the ball to a receiver 40m down field. The path of the ball can be modeled by the function $h(d) = -0.01(d - 20)^2 + 6$ where $h(t)$ is the height in m and d is the horizontal distance from the quarterback in m.

- a) What is the maximum height of the ball?
- b) What was the horizontal distance from the quarterback when the ball reached it's max height?
- c) What was the height of the ball when it was thrown? The ball was thrown to a receiver 40m down field, at what height was it caught?
- d) If a defensive back was 2m in front of the receiver, how far was he from the quarterback?
- e) How high would the defensive back need to reach to knock down the pass?

Answers:

1. a) 760 m b) 12 s c) 24.32 s d) $D = \{t \in R / 0 \leq t \leq 24.32\}$ $R = \{h \in R / 0 \leq h \leq 760\}$ 2.a) 11.025 m b) 0.5 s
c) 2 sec d) 9.8m e) 1 sec 3.a) 22m b) 2 sec c) 4.12 sec d) 2.4m 4. a) 6.24 sec b) 3.12 s c) 47.8 m
d) 5.5 s 5. a) 6m b) 20m c) 2m ; 2m d) 38m e) 2.76 m